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ABSTRACT

A qualitative investigation was undertaken of the impact of a yearlong secondary reading course and practicum on two preservice teachers' beliefs about reading instruction and their actual classroom practices. Course-related data included transcribed interviews with the course instructor, narratives of course observations, and copies of course materials/assignments. Classroom-related data included interviews and observations with the preservice teachers as they taught in their mathematics and science practicums, their written journal materials, and interviews with their university supervisors and cooperating teachers. These triangulated data were analyzed using a constant comparative method to describe the differences and similarities between the course instructor's and the teachers' reading beliefs and practices. Findings showed that, although both preservice teachers could articulate revised beliefs about reading instruction in content areas, they were unable to deepen their knowledge through application in classroom settings. Thus, neither incorporated reading instruction into their mathematics and science instruction as beginning teachers. Influences of these findings on some supervisors and suggestions for reading teacher education are discussed. (Author/AMH)

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Research Series No. 203

LEARNING TO TEACH READING IN SECONDARY MATH AND SCIENCE: BELIEFS, PRACTICE, AND CHANGE IN TEACHER EDUCATION

Sandra Hollingsworth and Karen Teel

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Abstract

This paper reports a qualitative investigation of the impact of a yearlong secondary reading course and practicum on two preservice teachers' beliefs about reading instruction and their actual classroom practices. Course-related data included transcribed interviews with the course instructor, narratives of course observations, and copies of course materials/assignments. Classroom-related data included interviews and observations with the preservice teachers as they taught in their mathematics and science practica, their written journal materials, and interviews with their university supervisors and cooperating teachers. These triangulated data were analyzed using a constant comparative method to describe the differences and similarities between the course instructor's and teachers' reading beliefs and practices. Findings showed that, although both preservice teachers could articulate revised beliefs about reading instruction in content areas, they were unable to deepen their knowledge through application in classroom settings. Thus, neither incorporated reading instruction into their mathematics and science instruction as beginning teachers. Influences on these findings and suggestions for reading teacher education are discussed.

LEARNING TO TEACH READING IN SECONDARY MATH AND SCIENCE: BELIEFS, PRACTICE, AND CHANGE IN TEACHER EDUCATION

Sandra Hollingsworth and Karen Teel[1]

In the early 1970s, the California Legislature mandated that teacher education programs add literacy courses to educate secondary as well as elementary candidates as literacy teachers. The need for such a requirement was--and is--clear. Thousands of students graduate from or drop out of high school each year without knowing how to read (Anderson, Hiebert, Scott, & Wilkinson, 1985).

Even with the California initiative and similar legislation in at least 36 other states, secondary teachers still do not teach reading (Conley, 1989; Ratekin, Simpson, Alvermann, & Dishner, 1985; Stewart & O'Brien, 1989). Content area teachers often do not see "reading teacher" as part of their professional role definition and/or they do not believe that they have time for reading instruction given the demands of the required curriculum. Further, the task of meeting the literacy needs of an increasingly diverse group of students across varying content areas seems overwhelming. Thus, even with the state required coursework, it would appear that teacher educators are not convincing secondary teachers to teach literacy. Why is this happening?

The Current Study: Purpose & Method

It was with that question in mind that we took a close look at the impact of a California secondary reading course on two preservice teachers' *beliefs* about reading instruction and on their actual *classroom practices*. Jerome and Bill (whose names have been changed to retain their anonymity) graduated from a fifth-year math- and science-centered teacher education program at the University of California (UC), Berkeley. Following graduation, Jerome accepted a position as a mathematics teacher in a public school and Bill as a science teacher in a private school.

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Method

To describe the impact of the secondary reading course on Jerome's and Bill's beliefs and their practices, we collected information in both the reading course and school classrooms. The course-related data included five interviews with the university secondary reading course instructor; 12 observations of university course sessions; and the examination of course materials, texts, and course assignments. The classroom-related data included 20 student teaching observations and interviews along with journal entries written twice monthly by each preservice teacher. Interviews were also periodically conducted with university supervisors and cooperating teachers. Finally, we completed follow-up interviews and observations in the teachers' own classrooms during their first and second years on the job.

During observations at both sites, we tape recorded lessons while writing narratives, then compiled summaries of the major concepts and activities. One of the five interviews with the university course instructor covered his rationale for the course, his goals, and his own philosophy of reading instruction. The other four interviews pertained to particular course sessions. The first interview with preservice teachers was an in-depth probe of their beliefs about teaching, learning, and literacy before the course began. Subsequent interviews and lesson observations were conducted twice a week over the course of the year's program and twice a month after graduation.

Using a constant comparative method (Glaser & Strauss, 1967), we regularly coded and summarized data from all sources to describe differences and similarities between the course instructor's and teachers' beliefs and practices, particularly as they pertained to *reading*. In this report we will describe learning to teach literacy in those terms.

The Secondary Reading Course

Foundations for Teaching Secondary Reading is required for all math and science preservice teachers in the Educational Research and Applications Single Subject Credential Program at UC, Berkeley. It is a yearlong course of 30 hour and one-half sessions running concurrently with daily classroom teaching practice. The course is taught by the same instructor during both semesters. He has been teaching it since 1974--the year that California initially

required secondary reading to be added to credential programs. He includes not only attention to reading but writing and other literacy/language competencies as well.

The reading instructor believes reading to be an ongoing active process of constructing meaning rather than a set of discrete skills to be mastered one at a time. He told us about his three broad goals for the course: (a) to introduce the preservice teachers to current theories in reading instruction, (b) to make them aware of how language functions as a medium of learning in their disciplines, and (c) to try and convince them that an interactive model of reading and language instruction is relevant to content area teaching such as science and mathematics.

The instructor planned to accomplish his goals for the course in two ways: by discussing the most current concepts in reading instruction and by requiring four course assignments: weekly text readings, a notebook of literacy activities, a content area textbook analysis, and a position paper on literacy instruction in math or science.

Course Sessions

During each course session, the instructor focused on particular issues which related to his three goals. To emphasize the importance of the interactive model of reading, he often had the teachers meet in groups to experience the benefits of cooperative and active learning. He focused on the importance of language as a medium of learning in mathematics and science at nearly every meeting. He asked a guest speaker to give a talk on uses of reading and writing materials in science and mathematics. In two course sessions, he showed how current constructive theories of reading comprehension are in conflict with the purpose and nature of the multiple-choice standardized tests that dominate our accountability procedures. He modeled different theoretically based reading strategies teachers might use with their students, particularly the integration of prior knowledge and new text-based concepts. The instructor also discussed ways to become sensitive observers of students' learning through text.

Learning as Changes in Belief and Practice

Jerome and Bill were 2 of 15 preservice teachers enrolled in the course. They represent the larger group's differing beliefs about reading instruction in secondary classrooms. The stories

reported here will outline Jerome and Bill's (a) incoming beliefs about reading instruction, (b) learning or changing beliefs during the reading course, and (c) classroom application of learned reading strategies.

Jerome

Jerome had enrolled in the teacher education program to earn a mathematics credential. In the first semester of the program, he was placed in a junior high school with a high minority population where he taught a class of gifted and talented eighth graders. In his second semester, Jerome was assigned to a multiethnic high school, where he taught low-ability prealgebra students in grades 10 through 12.

Incoming Beliefs About Reading Instruction

Jerome's first interview, completed the summer before he entered the teacher education program, described his belief that teachers should help math students read text *and* his ideas about learning to read:

> It is important for a student to be able to recognize letters and combinations of letters and the sounds that they make. By sounding out a written word, a student can compare the sounds to words they know and therefore recognize the meaning. Eventually, students recognize words and learn their meaning.

Rather than have content area teachers provide direct instruction in this process, Jerome saw teachers as mediators between the text and students' access to it. When math texts were "boring," the teacher had a responsibility to develop strategies to present the material in an interesting way. Given the potential diversity of students, teachers might use a variety of approaches to help them interact with text. Jerome also believed that the teacher must make sure that the students could "handle" the content presented (i.e., it was not too difficult) and that they be shown how it was relevant to their lives as much as possible.

What Jerome Learned in the Reading Course: Changes in Stated Beliefs

In his interviews, journal entries, field-based assignments, and university course assignments, Jerome demonstrated his growing understanding of reading instruction in math. By

looking across the data sources, we found stated evidence that he was accomplishing his reading instructor's course goals and modifying his initial ideas about literacy.

In October of his first semester, Jerome said that he was becoming more aware of the value and responsibility of students' *actual reading* to learn mathematics. He felt a need to let the students know that reading was as much of a requirement in his class as computation. He assigned reading homework and then quizzed students to see if they understood the text:

> The reading course instructor said that if you are going to assign reading you have to let students know that it is going to be used. It is important that they do the reading and so I wanted them to know that if I assigned reading, I expected them to do it and it was important. (Interview, 10/16)

Jerome began to integrate his new understanding of instructional strategies for ensuring that students read the text with his precourse belief in instructional variety. In his journal near the end of October, he wrote:

> A text provides another presentation of material to the student. Some students are visual learners. Others can listen to instruction and follow with few visual clues. Learners are all different and they learn differently. It is important to present the material in many different forms.

In the position paper assignment, Jerome demonstrated his growing theoretical understanding of reading, as set out by the course instructor:

> The reader must bring background knowledge into reading. The same is true for math. New concepts should be built upon concepts the student already knows. A student must use their prior knowledge to interact with mathematics. Just as they must use their prior knowledge to interact with the text when they are reading.

Jerome's paper also stressed the importance of language as a medium of learning in math instruction: "First of all, a student cannot understand mathematics unless [he/she] can read, write, and understand the language of mathematics." Finally, Jerome explained how he saw reading as an interaction between the reader and the text - a position which revealed modifications in his precourse beliefs about learning to read:

> I see reading as the process in which the reader interprets a collection of symbols and then reconstructs in [his/her] own mind the original meaning the author was trying to convey. I think it is possible to read without coming to a full understanding of the author's message. Great literature is written so that it can be interpreted at several different levels. However, when reading, the reader must achieve some level of understanding of the author's meaning.

In Jerome's literacy notebook, he illustrated a number of principles for teaching reading and writing, showing again that he was meeting the course instructor's goals. For example, he addressed the issue of background knowledge through exercises which required the students to discuss or write about what they already knew about a particular concept.

Jerome's Use of Learned Reading Strategies: Changes in Practice

Though the course instructor encouraged preservice teachers to apply their new knowledge in student teaching settings, he did not *require* such application, as new strategies might disrupt their regular classroom teachers' in-place routines. In his first field assignment, Jerome was able to try a few strategies suggested by the course instructor. For example, he assigned his eighth-grade gifted math class a section of the text to read. He found that the students could not answer some very simple questions about what they had read. Jerome brought this problem up for discussion in a university session.

As a rule, though, Jerome rarely practiced the reading strategies presented in the university course. In fact, his attempts declined over the year. A major reason for the decline was a perceived need to "cover the curriculum." In his journal at the end of the year, Jerome explained: "I am very occupied with just teaching the curriculum, and time prevents me from using the strategies more." Jerome also said that his decisions about reading instruction had to do with instructional priorities. He felt the students needed so much math instruction that he couldn't take the time away for reading.

Jerome's position did not change in his first two years of teaching. He still professed a belief in the concept of content area reading instruction, but could not justify the classroom time required for it.

Bill

Bill was a secondary science credential candidate in the same program at UC, Berkeley. In his first semester, he was placed in a suburban middle school in an eighth-grade general science class with a fairly homogeneous student population. In his second semester, Bill worked in a

multiethnic high school, teaching earth science to low tracked students and chemistry to the higher tracked classes.

Incoming Beliefs About Reading Instruction

At the beginning of his program, Bill was not sure how a teacher would teach reading nor of the process involved in reading. Bill was also skeptical about the possibility of using text to teach science because of the difficult language and lack of clarifying examples in science texts which often intimidate students. Bill believed in using a text as one of several resources--but only when it was appropriate to the given task. He also was opposed to strictly following the curriculum as outlined in a text.

What Bill Learned in the Reading Course: Stated Changes in Beliefs

In spite of his skepticism, across interviews, journal entries, field-based assignments, and university assignments, Bill demonstrated that he was meeting some of the instructor's course goals. In interviews and journal entries during the second semester of his teacher training, Bill explicitly mentioned ideas the instructor had discussed in class. For example, he wrote about the students' need to monitor their own cognitive processes in order to improve their reading skills. He talked about learning to value analysis of students' reading problems by remembering his own. Bill became aware of the relationship between reading ability and understanding science concepts.

In his textbook analysis assignment, Bill acknowledged the importance of analysis to make teachers aware of the parts of a text which might cause difficulties for students. He also wrote about the importance of "reflective reading" which

> involves successively higher thinking skills, as the reader gathers chunks of information, compares and groups them, identifies relationships and synthesizes that information to come to a conclusion or overall concept. Students [are not] used to this. [Teacher-prepared] activities help guide them along this path.

In his position paper too, Bill demonstrated changing ideas about literacy. He wrote: "Language is a crucial part of a student's classroom experience . . . , and a big part of one's participation in any science is learning the language of the field." Initially skeptical about using reading materials with his science classes because they are poorly written, by the time he wrote his

position paper he expressed a belief that working with the students on their reading skills was *critical* to their development as literate adults. He particularly acknowledged the value of teachers finding out their students' prior knowledge and their incoming beliefs about reading.

Bill's Use of Learned Reading Strategies: Changes in Practice

As mentioned earlier, the course instructor did not feel he could *require* the preservice teachers to apply their new literacy knowledge in student teaching. Thus, like Jerome, Bill rarely experimented with the strategies he was learning. The in-place classroom procedures limited his opportunities to try. In his first placement, Bill never used a textbook, since an alternative, laboratory-based curriculum for his cooperating teacher's eighth-grade science classes was already written and in place. Also, both Bill and his cooperating teacher expressed skepticism about the value of textbooks. Bill did have the students do some previewing of their lab sheets, though, and told his university class that the students seemed to find that exercise useful. In his second placement, Bill used the textbook more frequently--following his cooperating teachers' established procedures.

When Bill did use reading materials, he tried "study skill" strategies that were introduced and practiced in the reading course. He modified commercial worksheets which accompanied the text to incorporate vocabulary and comprehension questions. He limited such changes to those presented in the course with sufficient guided practice. Bill was rarely satisfied with his efforts. In March, he wrote in his journal:

> But I must admit I don't know what exactly I am trying to do with the exercises other than just get some reading and writing in to the science class. I don't have a sequence of developing study skills, or reading techniques or a specific writing style.

In an interview at the end of May, Bill said: "I am still uncomfortable translating what I know into lesson plans that will work with students." He wrote to the course instructor about related problems: "And I realize that I don't have a good idea of how to introduce reading activities as something exciting and important, especially to my less-motivated earth science class."

In addition, Bill claimed that the pace of the nine-month teacher training program did not allow time to plan ways to implement new strategies in his classrooms.

Finally, he noted that his cooperating teachers' established approaches did not always lend themselves to using such experimental strategies. "I think that I can say fairly that the [university] and the [classroom] experiences are not integrated very well . . . it would be nice if what we did in class carried into our experience in the schools better" (Journal entry, March 10). As a result of these experiences, even though he had "learned" what the instructor intended, Bill rarely taught reading as a beginning teacher in his own classroom. He attributed this to content coverage requirements, difficult texts, and lack of integrative coaching during his first two years.

Discussion

It appears that the course instructor succeeded in having Jerome and Bill articulate revised beliefs about reading and writing instruction in content areas. Based on their course assignment performances, they both appeared to understand the central course messages. However, there was little evidence of their actual application of these theories in classroom settings. Jerome and Bill were not asked to integrate and deepen their knowledge of literacy instruction through actual practice. The lack of such accountability may have also influenced how seriously they considered the instructor's "encouraged tasks" (Doyle & Carter, 1984).

Additionally, there was little guidance for Jerome's and Bill's initial attempts to apply what they were learning. Interviews with their field supervisors showed that they paid little attention to reading instruction during their visits. Their primary attention was to classroom management and to developing harmonious relations between the preservice teachers and their cooperating teachers. Our occasional observations of cooperating teachers also revealed the lack of models for integrating reading and content instruction in the classroom. Consequently, there were no experiential requirements, coaching support, or role models which might have encouraged Jerome and Bill to apply what they were learning and deepen their understanding (Dewey, 1933; Joyce & Showers, 1988).

Implications For Changes in Teacher Education

Though limited to descriptions of two teachers in a single program, the stories told here corroborate others about the difficulty of changing beliefs and classroom practice (Conley, 1986; Lanier & Little, 1986; Zeichner, 1986). In this instance we found that, while beginning secondary teachers may learn to *value theories* which support content area reading instruction, the *applied curriculum decisions* they make often do not include the teaching of reading. Clearly the assumption that learning from course work will lead to changes in classroom practice is one worth challenging. Without seeing for themselves that attention to literacy really helps improve students' math and science learning, Jerome and Bill could not fully accept the need for literacy instruction (Hollingsworth, 1989).

This study suggests some ideas for change. Content area reading courses and teacher education programs might (a) encourage reflection on school-based constraints which limit content area reading instruction, (b) choose teaching practice settings where content area reading is modeled, (c) collaborate with cooperating teachers to provide opportunities for practicing new literacy strategies in field placements, (d) educate university supervisors to observe and coach preservice teachers' reading instruction, and (e) include more guided practice and discussions of attempted classroom instruction in reading courses.

Epilogue: Change in Action

As a result of reading this study, one supervisor in the program did systematically begin to attend to issues of literacy in his field visits. Jerome's and Bill's reading course instructor began to invite secondary math and science teachers to the university to discuss their integration of reading and content instruction. During the following school year, the course instructor also required preservice teachers to design and present alternative lessons collaboratively, integrating reading into their subject areas. In addition, he set aside more time to guide changes in the preservice teachers' practice through discussions of their actual attempts to apply the reading theories in their field experiences.

During the second semester, the instructor asked the students to organize themselves by subject matter and to design methods to integrate theory and practice, taking into account their real classroom constraints. We observed two of those sessions and talked with the new cohort of preservice teachers. They reported not only a change in beliefs but corresponding changes in content area instruction. Though follow-up observations are needed to substantiate these reports, the changes in teacher educators' practices that resulted from sharing study results are a promising first step.

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